REMARKS

By this amendment, claims 1-12, 17-20, 26-32, 34-38 and 89-130 are pending in the application. Of these, claims 1, 12, 19, 26 and 129 are being amended. The claim amendments are supported by the specification and original claims, and no new matter is being added. For example, the language "extending into the interior of the process chamber" is supported at least by originally filed claim 12 and by Figures 1, 6a, 7 and 8a. Thus, entry of the amendments and reconsideration of the present case is requested.

Double Patenting Rejection

The examiner rejected claims 10, 11, 17, 18, 37, 38 and 89-128 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-66 of U.S. Patent No. 6,390,019 to Grimbergen et al in view of JP 9-126991 to Oshida et al.

A terminal disclaimer in compliance with 37 CFR 1.321(c) will be filed by Applicant when the claims are allowed, thus, the double-patenting rejection is now obviated.

Rejection under 35 U.S.C. 102 of Claims 1-4, 8, 9, 12, 19, 20, 26-29, 32, 35 and 36

The Examiner rejected claims 26, 27, 29, 32, 35 and 36 under 35 U.S.C 102(b) as being anticipated by JP 9-126991 to Oshida et al. This rejection is traversed.

As amended, claim 26 is not anticipated by Oshida et al, because Oshida et al does not teach "an overlying mask comprising a plurality of apertures having an aspect ratio that is selected to reduce deposition of process residues on the radiation transmitting portion...."

Instead, Oshida et al teaches:

> [b]y means of said perforated opaque filters (13) and (20), it is possible for the optical system to always be under the same conditions without contamination by attachment of milling particles on them" (paragraph 26.)

Thus, Oshida et al teaches a filter capable of blocking milling particles from reaching the optical system. Oshida et al's filter blocks the particles by having holes with a width sized smaller than the particles. Oshida et al's filter with small holes is not the same as the claimed mask having a hole with a defined aspect ratio (i.e., length divided by width) that is selected to reduce deposition on an underlying radiation transmitting portion. Oshida et al does not teach that the thickness of hole is also important to block the milling particles. For example, a sieve has holes that are sized to retain particles larger than the holes in the sieve. The thickness of the sieve is not important; otherwise, sieves would not be made of two dimensional wire mesh which has little or no thickness dimension

Furthermore, Oshida's filter is "opaque," and thus not able to transmit radiation therethrough except through the holes therein. For the holes, Oshida et al teaches that "the ratio of diameter D to hole pitch P" is selected to "make effective use of the illuminating light" (emphasis added, paragraph 26), and "the relationship between hole pitch P and filter thickness t is optimized corresponding to the directionality of illuminating optical system (2)" (emphasis added, paragraph 26.) Thus, Oshida et al teaches that the thickness and hole pitch (angle) parameters of the opaque filter are selected to meet optical requirements, namely, to control the directionality of the holes to receive particular illuminating light from a particular location and not to block milling particles from entering and reaching the optical system. Thus, Oshida et al does not teach a mask having apertures with an aspect ratio to reduce deposition of process residues on a radiation transmitting portion. Accordingly, claim 26 and the claims depending therefrom are not anticipated by Oshida et al.

The Examiner rejected claims 1-4, 8, 9, 12, 19, 20, 26-29, 32, 35 and 36 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 5,759,424 to Imatake et al. This rejection is traversed.

Claim 1 is not anticipated by Imatake et al because Imatake et al does not teach "a mask overlying the radiation transmitting portion and extending into the interior of the process chamber," as recited in the claim. Instead, Imatake teaches plasma shielding means 14 that does not extend into the interior of the chamber, but instead is positioned in a recess behind the wall 20 of the processing chamber, as shown for example in Figure 4. Accordingly, claim 1 and the claims depending therefrom are not anticipated by Imatake et al.

Similarly, claims 12, 19, recite "extending into the interior of the chamber" and claim 26 recites a mask "adapted to extend into the interior of the chamber." Thus, these claims and the claims depending therefrom are not anticipated by Imatake et al because Imatake et al does not teach a mask extending into the interior of the chamber.

Rejection under 35 U.S.C 103(a) of Claims 1-9, 12, 19, 20, 28, 30, 31, 34, 129 and 130

The Examiner rejected claims 1-9, 12, 19, 20, 129 and 130 under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,290,383 to Koshimizu et al in view of Oshida et al. This rejection is traversed.

Claim 1 is patentable over Koshimizu et al in view of Oshida et al because neither of the references teaches or suggests "mask having an aperture comprising an aspect ratio that is selected to reduce deposition of process residue on the radiation transmitting portion," as recited in the claim. Koshimizu et al teaches a reactor with a window 11, for example as shown in figure 1, but does not teach or suggest a mask overlying the window, or a mask having an aperture with an aspect ratio selected to reduce the deposition of process residue on the window. Accordingly, claim 1 and the claims depending therefrom are patentable over Koshimizu.

Oshida et al does not make up for the deficiencies of Koshimizu et al. As discussed above, Oshida et al does not teach an aperture having an aspect ratio selected to reduce deposition, and instead teaches a perforated opaque filter that filters away material from the optical system using holes sized smaller than the particles. Furthermore, one of ordinary skill in the art would not find it obvious from the teachings of Oshida et al to provide an aperture having an aspect ratio selected to reduce deposition. Oshida et al does not teach or suggest that the aspect ratio could be selected to be either sufficiently large to "limit access of the neutral flux of process gas," or sufficiently small such that the aperture "preferentially filters out energetic plasma species to allow a higher percentage of highly directional and energetic plasma species to enter the aperture 145 and sputter-etch away the process residue deposited on the sidewall," as described for example on page 14 of the specification. Instead, Oshida et al teaches filtering particles, and selecting parameters with respect to optical requirements, but does not teach or suggest that selecting an aperture length with respect to a width could reduce the deposition of residues on a radiation transmitting portion. Thus, neither Koshimizu et al nor Oshida et al teach or suggest the claimed mask having the aperture with an aspect ratio selected to reduce deposition, and claim 1 and the claims depending therefrom are patentable over Oshida et al.

Furthermore, claim 1 is not obvious over Koshimizu et al in view of Oshida et al because there is no teaching or suggestion in either of the references to provide "a wall comprising a radiation transmitting portion ... [and] a mask overlying the radiation transmitting portion," as recited in the claim (emphasis added.) Koshimizu et al does not teach or suggest a mask overlying a radiation transmitting portion. Oshida et al teaches a perforated opaque filter that is a part of an optical system that is positioned inside the chamber walls and in close proximity to the substrate, as shown for example in Figure 1, but does not teach or suggest a mask overlying a radiation transmitting portion that is a part of a chamber wall. The perforated opaque filter of Oshida et al that is placed in close proximity to the substrate can be understood by one of ordinary skill in the art to be useful for filtering away any particles generated during processing of the

substrate that might otherwise adhere to the closely placed optical system, such as any large particles sputtered from the substrate during processing. However, it is not obvious that such a filter would be useful to reduce deposition on a radiation transmitting portion that is a part of a chamber wall, as the wall is further removed from the substrate than the optical system of Oshida et al, and thus the deposition of residue is more likely to come from volatilized process gas byproducts than from any large particles that may be sputtered from the substrate during processing. Accordingly, one of ordinary skill in the art would not have found it obvious to combine the teachings of Koshimizu et al with Oshida et al, and claim 1 and the claims depending therefrom are patentable over these references.

Claim 12 is similarly patentable over Koshimizu et al in view of Oshida et al because neither of the references teaches or suggests "a wall comprising a radiation transmitting portion ... [and] a mask overlying the radiation transmitting portion and extending into the interior of the chamber, the mask having an aperture comprising an aspect ratio that is sufficiently small ... to reduce deposition of process residue on the radiation transmitting portion," as recited in the claim. Instead, as discussed above, Koshimizu et al does not teach or suggest a mask having apertures, and Oshida et al teaches a perforated opaque filter, but does not teach or suggest a mask having an aperture with an aspect ratio selected to reduce the deposition of process residue. It is furthermore not obvious to combine the teachings of Koshimizu et al with Oshida et al because the references do not teach or suggest that the filter of Oshida et al would reduce deposition on a radiation transmitting portion that is a part of a wall.

Furthermore, claim 12 is patentable over Koshimizu et al in view of Oshida et al because neither of the references teaches or suggests "the aspect ratio being from about 1:1 to about 12:1," as recited in the claim. Koshimizu et al does not teach a mask having an aperture with an aspect ratio, and Oshida et al does not teach an aspect ratio that is selected to reduce deposition, or an aspect ratio within the recited range. Accordingly claim 12 and the claims depending therefrom are patentable over Koshimizu et al in view of Oshida et al.

Claim 19 is patentable over Koshimizu et al in view of Oshida et al because neither of the references teaches or suggests a "wall comprising a radiation transmitting portion comprising a mask ... the mask having a plurality of apertures, the apertures having an aspect ratio that is selected to reduce deposition of process residues on the radiation transmitting portion," as recited in the claim. Instead, as discussed above, Koshimizu does not teach or suggest a mask and Oshida et al does not teach or suggest an aspect ratio selected to reduce deposition. There is also no motivation to combine Koshimizu et al and Oshida et al because the references do not teach or suggest that the filter of Oshida et al would reduce deposition on a radiation transmitting portion that is a part of a chamber wall. Accordingly, claim 19 and the claims depending therefrom are patentable over Koshimizu et al in view of Oshida et al.

Claim 129 is patentable over Koshimizu et al in view of Oshida et al because neither of the references teaches or suggests "a wall comprising a radiation transmitting portion ... [and] a mask overlying the radiation transmitting portion and extending into the interior of the chamber, the mask having an aperture comprising an aspect ratio that is sufficiently small to ... reduce deposition of process residue on the radiation transmitting portion," as recited in the claim. Instead, as discussed above, neither Koshimizu et al nor Oshida et al teach or suggest a mask overlying a radiation transmitting portion that is a part of a wall, and do not teach or suggest selecting an aspect ratio to reduce deposition.

Furthermore, claim 129 is patentable over Koshimizu et al in view of Oshida et al because neither of the references teaches or suggests "an aperture comprising an aspect ratio that is sufficiently small to allow ions of the energized gas to enter the aperture and etch away the process residues formed on a sidewall of the aperture and the radiation transmitting portion to reduce deposition of process residue on the radiation transmitting portion, the aspect ratio being from about 0.25:1 to about 3:1," as recited in the claim. Koshimizu et al does not teach or suggest a mask having an aperture with an aspect ratio, and Oshida et al does not teach or suggest an aspect

ratio that is selected to reduce deposition, or an aspect ratio within the recited range. Furthermore, such an aspect ratio would not be obvious over Oshida et al's filter teachings, as the claimed aspect ratio is sufficiently small to allow energized gas species through, whereas Oshida teaches a filter that blocks particles from passing therethrough. Accordingly claim 129 and the claims depending therefrom are patentable over Koshimizu et al in view of Oshida et al.

The Examiner rejected claims 6, 7, 31 and 34 under 35 U.S.C. 103(a) as being unpatentable over Imatake et al. This rejection is traversed.

Claim 1, from which claims 6 and 7 depend, is patentable over Imatake et al because Imatake et al does not teach or suggest "a mask overlying the radiation transmitting portion and extending into the interior of the process chamber," as recited in the claim. Instead, as discussed above, Imatake et al teaches shielding means that is positioned in a recess behind the chamber wall. Furthermore, a mask extending into the interior of the process chamber is not obvious over the recessed shielding means of Imatake et al, because Imatake et al does not teach or suggest the benefits of providing a mask that extends into the interior of the chamber, such as the reduced footprint or amount of space that the chamber having the claimed mask takes up over a chamber having only a recessed portion. The mask extending into the interior of the chamber also allows for the monitoring of a larger sampling area that is not limited to the area exposed to a recess. With a recessed mask that does not extend into the interior of the chamber, on the other hand, the radiation transmitting portion is necessarily recessed behind the chamber wall, and thus the viewable area is limited to an area that is closer to the opening size of the recess, as discussed for example in the specification on page 2, second full paragraph. Thus, as Imatake et al fails to teach or suggest the claimed mask or any of the benefits provided by the claimed mask, claim 1 and the claims depending therefrom are patentable over Imatake et al.

Furthermore, dependent claim 5 is patentable over Imatake et al because Imatake et al does not teach or suggest an "aperture has an aspect ratio of from about

0.25:1 to about 3:1," as recited in the claim. Instead, Imatake et al teaches that "when the axial length of the hole 17 is selected to be no smaller than five times of a diameter, the electrons are easy to be lost by the inner wall of the hole" (column 14, lines 21-24.) Thus, Imatake et al teaches that an aspect ratio should be no less than 5:1, but does not teach or suggest that deposition is reduced by providing the claimed smaller aspect ratio of from about 0.25:1 to about 3:1. Imatake et al does not teach or suggest the benefits of a smaller aspect ratio that reduces deposition by allowing energetic plasma species to enter the aperture and etch away deposits, as described for example in the specification on page 14, first full paragraph. Accordingly, one of ordinary skill in the art would be taught away from an aspect ratio of less than 5:1 by Imatake et al, and thus the aperture having the claimed smaller ratio is not obvious over Imatake et al.

Claim 26, from which claims 31 and 34 depend, is patentable over Imatake et al because Imatake does not teach or suggest "an overlying mask adapted to extend into the interior of the chamber," as recited in the claim. Instead, as discussed above, Imatake et al teaches a recessed shielding means, but does not teach or suggest the desirability of any benefits of providing a mask extending into the interior of the chamber. Accordingly, claim 26 and the claims depending therefrom are patentable over Imatake et al.

Claim 30, which depends from claim 26, is furthermore patentable over Imatake et al because, as discussed above, Imatake et al does not teach or suggest that the "apertures have an aspect ratio of from about 0.25:1 to about 3:1" and instead teaches that an aspect ratio should not be less than 5:1.

The Examiner rejected claims 28, 30, 31 and 34 under 35 U.S.C. 103(a) as being unpatentable over Oshida et al. This rejection is traversed

Claim 26, from which claims 28, 30, 31 and 34 depend, is patentable over Oshida et al because Oshida et al does not teach or suggest a "mask comprising a plurality of apertures having an aspect ratio that is selected to reduce deposition of

process residues on the radiation transmitting portion," as recited in th claim. Instead, as discussed above, Oshida et al teaches a filter to filter away material from an optical system, but does not teach or suggest selecting an aspect ratio to reduce deposition. Accordingly, claim 26 and the claims depending therefrom are patentable over Oshida et al.

CONCLUSION

The above-discussed amendments and remarks are believed to place the present application in condition for allowance. Should the Examiner have any questions regarding the above remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,
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Date: 2/6/2003

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MARKED-UP CLAIMS FOR S/N: 09/610,237

1. (amended three times) A substrate processing chamber comprising:

(a) a support;

(b) a gas distributor;

(c) a gas energizer;

(d) a wall comprising a radiation transmitting portion;

(e) a mask overlying the radiation transmitting portion and extending into the interior of the process chamber, the mask having an aperture comprising an aspect ratio that is selected to reduce deposition of process residue on the radiation transmitting portion; and

(f) an exhaust,

whereby a substrate held on the support may be processed by process gas distributed by the gas distributor, energized by the gas energizer, and exhausted by the exhaust, and whereby radiation may be transmitted through the aperture of the mask and the radiation transmitting portion.

12. (twice amended) A substrate processing chamber comprising:

(a) a support having a receiving surface capable of supporting a substrate;

(b) a gas distributor capable of providing process gas in the chamber and a gas energizer that is capable of coupling energy to the process gas;

(c) a wall comprising a radiation transmitting portion that allows radiation to be transmitted therethrough to monitor processing of the substrate;

(d) a mask overlying the radiation transmitting portion and extending into the interior of the chamber, the mask having an aperture comprising an aspect ratio that is selected to reduce deposition of process residue on the radiation transmitting portion, the aspect ratio being from about 1:1 to about 12:1; and

(e) an exhaust capable of exhausting process gas from the chamber.

19. (amended three times) A substrate processing chamber comprising:

(a) a support;

(b) a gas distributor;

(c) a gas energizer;

(d) a wall comprising a radiation transmitting portion comprising a mask extending into the interior of the chamber, the mask having [with] a plurality of apertures, the apertures having an aspect ratio that is selected to reduce deposition of process residues on the radiation transmitting portion; and

(e) an exhaust,

whereby a substrate held on the support may be processed by process gas distributed by the gas distributor, energized by the gas energizer, and exhausted by the exhaust, and whereby radiation may be transmitted through the apertures and the radiation transmitting portion.

26. (twice amended) A window capable of being mounted on a process chamber, the window comprising:

a radiation transmitting portion adapted to be mounted on a wall in the process chamber; and

an overlying mask adapted to extend into the interior of the chamber, the overlying mask comprising a plurality of apertures having an aspect ratio that is selected to reduce deposition of process residues on the radiation transmitting portion,

whereby radiation may be transmitted through the window when a substrate is processed in the process chamber.

129. (amended)) A substrate processing chamber comprising:

(a) a support having a receiving surface capable of supporting a substrate;

(b) a gas distributor capable of providing process gas in the chamber and a gas energizer that is capable of coupling energy to the process gas;

(c) a wall comprising a radiation transmitting portion that allows radiation to be transmitted therethrough to monitor processing of the substrate;

(d) a mask overlying the radiation transmitting portion and extending into the interior of the chamber, the mask having an aperture comprising an aspect ratio that is sufficiently small to allow ions of the energized gas to enter the aperture and etch away the process residues formed on a sidewall of the aperture and the radiation transmitting portion [selected] to reduce deposition of process residue on the radiation transmitting portion, the aspect ratio being from about 0.25:1 to about 3:1; and

(e) an exhaust capable of exhausting process gas from the chamber.